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(54) SOLAR HEATING SHINGLE ROOF STRUCTURE

(71) I, GEORGE THOMAS STRAZA, a citizen of the United States of America, of 1071 Industrial Place, El Cajon, California 92020, United States of America, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:–

This invention relates to a solar heating shingle roof structure.

Roof mounted solar heating panels have been constructed in many different forms and are usually self contained units, which are attached on or inset in a portion of a roof. The cost of the panel structure is additional to the roof, and in many installations the roof structure does not provide an ideal support. When solar panels are applied to an existing building, they often detract from the appearance of the structure.

According to the present invention a solar heating shingle roof structure comprises a plurality of parallel rows of longitudinally interconnected and laterally overlapping fluid conducting shingles having means for facilitating their attachment to a roof structure, each shingle comprising a hollow body of substantially rectangular, thin, flat configuration having an upper sheet defining an upper surface, a lower sheet defining a lower surface, an upper transverse edge and a lower transverse edge, said upper and lower sheets being spaced apart and defining at least one flow passage therebetween, each shingle having at least one fluid inlet defined by socket means adjacent the upper edge and at least one fluid outlet defined by socket means adjacent the upper edge and at least one fluid outlet defined by hollow plug means adjacent the lower edge thereof, the inlet and the outlet communicating with said flow passage, said plug and socket means of longitudinally adjacent overlapping shingles being interconnected.

The structure incorporates a fluid conducting solar heating panel into a shingled roof. Each individual shingle is a hollow body with the general size and configuration of a conventional roof shingle, and has at least one inlet and outlet for fluid flow through the interior along the length ofthe body.

Each shingle may have pillars extending between the upper and lower sheets at least some of which are adapted to receive nails for securing the shingle in a conventional manner without the danger of leakage. Fluid, such as water, is fed into the upper portion of the shingle assembly from an inlet manifold which may be contained in a cap, as normally used at the peak of a roof. An outlet manifold is connected to the outlets of the lowest row of shingles.

The shingles can be transparent, or made decorative in any suitable manner which will permit efficient heating of the fluid passing through. Various fluid flow and control systems may be used with the shingle installation, depending on the particular use for and type of fluid to be heated.

The invention also includes a solar heating roof shingle comprising, a hollow body of substantially rectangular, thin, flat configuration having an upper surface defined by an upper sheet, a lower surface defined by a lower sheet, an upper transverse end, and a lower transverse end, and at least one fluid passageway defined between said upper and lower surfaces and extending between said ends, which define the width of the body, said body having at least one fluid inlet defined by a socket in the upper end, and at least one fluid outlet defined by a hollow plug in the lower end thereof, and means in said body for facilitating its attachment to a roof structure.

The invention will now be described by way of example with reference to the accompanying drawings, in which:–

Figure 1 is a top plan view of a portion of a typical roof structure of the invention;

Figure 2 is a perspective view of a shingle of the invention;

Figure 3 is an enlarged sectional view taken on line 3–3 of Figure 2;

Figure 4 is a sectional view taken on line 4–4 of Figure 3;

Figure 5 is a sectional view taken on line 5–5 of Figure 3;

Figure 6 is a sectional view taken on line 6–6 of Figure 3;

Figure 7 is an enlarged sectional view taken on line 7–7 of Figure 1;

Figure 8 is a perspective view of an inlet manifold section; and

Figure 9 is a sectional view similar to a portion of Figure 7, showing the initial interconnection of two shingles.

Referring first to Figures 1 through 4 of the drawing, there is illustrated a roof structure constructed of a plujality of shingles in accordance with the invention. The individual shingles are such as illustrated in Figure 2 and overlap in parallel longitudinally extending rows as illustrated in Figure 1. The longitudinally extending rows are interconnected to provide fluid flow channels between an inlet manifold and an outlet manifold between channels defined by the shingle structure.

The roof structure as illustrated in Figure 1, shows a plurality of shingles 10 connected end to end between the inlet and outlet manifolds and overlapping adjacent rows of shingles to define a weather proof structure. The shingle as best seen in Figures 2 to 4 includes an upper panel or sheet 12 connected in spaced relation to a lower panel or sheet 14 defining a flow passage or channel 16 between an upper inlet 18 defined by generally rectangular socket and a lower outlet 20 defined by a generally rectangular plug 22. Thus the outlet plug 22 of one shingle is designed to fit and seat firmly into a socket 18 of a lower shingle.

The upper sheet or panel 12 includes an upwardly turned edge flange 24 extending longitudinally along one edge thereof, and an inverted generally V-shaped cap flange 26 extending generally longitudinally along the opposite edge thereof. These flanges overlap adjacent shingles for providing a weather proof or weather tight roof structure.

The lower panel 14 as best seen in Figures 5 and 6 in the preferred embodiment includes upwardly extending side edges defining longitudinally extending side walls 28 and 30. The two panels 12 and 14 are preferably welded or bonded in a suitable manner along seams 32 and 34 between the side walls 28 and 30 and the under side of the upper panel 12. Longitudinally extending ribs 36 and 38 or similar formations are also formed along adjacent the edges of the shingle structure at a position of connection between the upper and lower sheets or panels 12 and 14. These stiffening ribs or the like enhance the longitudinal strength of the shingle structure and serve to align the panels during assembly. Additional strengthening of the structure is provided by means of a plurwlity of pillars 40 extending between the upper and lower panels 12 and 14 as shown in Figures 5 and 6. These may be formed as shown in Figure 5 by an inverted cup like projection extending upward from the lower panel or sheet 14.

Attaching or nailing pillars 42 and 44 are provided or formed as shown in Figure 5. These pillars are preferably frmed by an upwardly extending cup from the lower sheet 14 and downwardly extending cups from the upper sheet 12 meeting at a position just slightly below the plane of the upper sheet. These provide portion sealed off from channel 16 for receiving nails 45 or other suitable connecting means, for securing the shingle to a roof structure, as in Figure 7. Thus, holes may be formed in the pillars or columns without causing leakage from the inside of the channel. The upper ends of the columns 40 are preferably secured to the underside of the upper sheet such as by welding or by a suitable bonding agent.

Turning now to Figure 3 and, as also may be seen in Figurs 7 and 9, the lower sheet or panel 14 is provided with transverse ribs or stiffecers 46 extending upward and transverse of the lower sheet or panel 14. These stiffereners also act as deflector ribs to throw heat conducting fluids such as water, against the under side of the top panel 12 for continuous washing of the underside thereof. This prevents moisture condensation or build up on the under side of the upper panel which would result in a reduction in the heat transmisstion therethrough. It likewise provides a continuous contact of the fluid or water with the underside of the upper panel. This tends to increase the heat transfer to the fluid medium.

As best seen in Figures 2 and 4, the outlet plug 22 includes an upper sheet 23 cooperating with and spaced upward from an extension of the lower sheet 14 for defining the outlet in the form of a plurality of outlet passageways 20 defined by a plurality of upwardly longitudinally extending stiffeners 14a which supports the sheet 23 and 14 in spaced relationship to maintain the outlet opening. This prevents collapse of the opening and possible cutting off of communication between a pair of interconnected shingles. The inner end of the sheet 23 is curved forward as shwon inFigure 3 and connected to the underside of sheet 12 at the transverse rib 48 which may also serve as a rein-

forcing rib or structure. This leaves a space between the upper surface of the plug 22 and the underside of sheet 12 defined by an extension thereof, referred to as a skirt 12a, for receiving the upper end of the upper sheet of a lower shingle. This skirt 12a overlaps the interconnection of the plug 22 with the down stream or downslope socket of a longitudinally connected similar shingle.

As best seen in Figure 9, an outlet plug 22 fits within an inlet socket 18 at the upper end of a downstream shingle 10 with the skirt 12 a of the upper panel or shingle 10 overlapping the upper end of the upper surface of the sheet 12. This ensures a leak proof construction between upper and lower shingles. Thus with this shingle construction, longitudinally disposed shingles are fluid connected for passage of fluids therethrough. Adjacent rows of shingles are sealingly connected with overlapping flanges 24 and 26 to provide a leak proof roof structure.

The upper sheet or panel 12 is preferably of a transparent durable material such as a suitable plastics and the lower sheet 14 is preferably of a non-transparent durable material preferably black in color. The lower panel or sheet 14 may also be transparent and a black supporting surface provided beneath it for absorbing the solar radiation applied thereto.

As best seen in Figures 1, 7 and 8, the shingles are designed to interconnect with an upper inlet manifold designated generally by the numeral 50 and a lower outlet manifold designated generally by the numeral 52. The inlet manifold comprises a generally open channel or trough member with a lowr sheet 54 defining the bottom thereof and including an upturned portion defining an upper end or wall 56. An upper sheet 58 extends to form a lower end wall 60 of the channel and includes side walls 62 and 64 with arcuate shaped support or saddle portions 66 and 68 respectively. The sheet 58 also includes an edge flange 70 and cap flange 72 similar to those on the shingles.

The upper manifold 50 includes an inner channel defined by the above structure which communicates with an outlet 74 defined by a plug 76. The plug 76 includes a lower wall defined by the sheet 54 and an upper wall defined by an additional sheet 78, similar in function to sheet 23. These sheets are interconnected by means of ribs or longitudinal stiffness similar to those in the outlet of the shingle as shown in Figure 4. This defines a plurality of outlet channels or openings 74 for communicating with the inlet socket at the upper end of a shingle 10. The upper sheet 58 also defines a skirt overlapping the upper end of the shivgle 10 and likewise extending beyond the connection thereof with the plug and socket members. The channel 50 receives a conduit member 80 which rests within the support or saddle member 66 and 68. The conduit 80 may simply rest on the support structure or be secured thereto by suitable clamping or fastening means such as gluing.

Communication between the interior of the conduit 80 and open channel of the manifold 50 is accomplished by suitable ports or openings 82 in the lower wall of the conduit 80 to permit a fluid such as water, flowing along the conduit 80 to pour into the manifold and to communicate along the passageway defined by a longitudinally series of interconnected shingles. The fluid communicated thereto passes through the shingles and is heated by solar energy directed thereto before it reahces the outlet manifold 52. The inlet manifold 50 may be covered by a suitable cap member 84. This cap member may be disposed in any position on the roof or it may be at the ridge line of the roof.

The outlet manifold 52 comprises a generally tubular elongated member 86 having an inlet socket 88 extending from one side for receiving the outlet plugs 22 of shingles connected thereto. Again the skirt 12a of a shingle connected thereto overlaps the plug and socket interconnection between the shingle and the outlet manifold 52.

The structure herein is designed to be primarily a gravity flow system. Therefore the system would be mounted in an inclined fashion as shown in Figure 7 on a sloping roof or support structure shown in phantom at 90. This structure may be a sub-roof with the shingle structure of the present icvention defining the actual roof itself. Thus, the expense of a separate roof is avoided. The present construction is designed to serve as the actual roof structure itself as well as the solar energy collector. Thus with initial installations at the new sites the cost of the solar energy collecting system may be comparable to or only nominally above that of a conventional roof. The roof structure is also designed to blend into and/or simulate that of a shingle roof. In this regard the upper surface of the respective shingles may be formed with suitable decorative or grained patterns to simular wood shingles or the line.

WHAT I CLAIM IS:–

1. A solar heating shingle roof structure, comprising:–

a plurality of parallel rows of longitudinally interconnected and laterally overlapping fluid conducting shingles having means for facilitating their attachment to a roof structure;

each shingle comprising a hollow body of substantially rectangular, thin, flat configuration, having an upper sheet defining an upper surface, a lower sheet defining a lower surface, an upper transverse

edge and a lower transverse edge, said upper and lower sheets being spaced apart and defining at least one flow passage therebetween;

each shingle having at least one fluid inlet defined by socket means adjacent the upper edge and at least one fluid outlet defined by hgllow plug means adjacent the lower edge thereof, the inlet and the outlet communicating with said flow passage;

said plug and socket means of longitudinally adjacent overlapping shingles being interconnected.

2. A solar heating shingle roof structure according to claim 1, wherein the means for facilitating the attachment comprises a solid portion between the upper and lower sheets of each shingle, for receiving nails therethrough.

3. A solar heating shingle roof structure according to claim 1, and including an inlet manifold connected to the inlets of the row of shingles at the upper edge of the structure;

and an outlet manifold connected to the outlets of the row of shingles at the lower edge of the structure.

4. A solar heating shingle roof structure according to claim 3, wherein said inlet manifold comprises an upwardly opening channel;

a conduit supported by the channel above the opening thereof; and

at least one opening in the wall of said conduit communicating with the opening;

and the inlet manifold includes an outlet defined by hollow plug means for connecting into yhe socket means of each of the uppermost row, and

skirt means for overlapping the connections of the hollow plug means with the sockets of the shingles.

5. A solar heating shingle roof structure according toc laim 1 wherein each shingle includes a skirt overlapping the inter connection between longitudinally interconnected panels;

and the plug means and the socket means each extend longitudinally of the shingle.

6. A solar heating shingle roof structure according to claim 1, wherein the inlet and the outlet openings are substantially the same width as the flow passage;

and each of the shingles includes a cap flange overlapping a flange on an adjacent shingle.

7. A solar heating shingle roof structure according to claim 3, wherein the outlet manifold comprises conduit means having a plurality of inlet socket means for connecting to the outlet sockets of the row of shingles at said other edge of the structure.

8. A solar heating shingle roof structure according to claim 1, wherein transverse rib means extend across said flow passage for directing fluid along the passage upward against the underside of the upper sheet;

and wherein a plurality of pillars extend between the upper and the lower sheets for supporting the sheets in spaced apart relationship.

9. A solar heating roof shingle, comprising

a hollow body of substantially rectangular, thin, flat configuration having an upper surface defined by an upper sheet, a lower surface defined by a lower sheet, an upper transverse end, and a lower transverse end, and at least one fluid passageway defined between said upper and lower surfaces and extending between said ends, which define the width of the body,

said body having at least one fluid inlet defined by a socket in the upper end, and at least one fluid outlet defined by a hollow plug in the lower end thereof,

and means in said body for facilitating its attachment to a roof structure.

10. A solar heating roof shingle according to claim 9, wherein the socket is a generally rectangular opening in the upper end, and the outlet is a corresponding generally rectangular opening in the plug in the lower end,

and said means for facilitating attachment comprises a solid portion of the body extending between the upper sheet and said lower sheet.

11. A solar heating roof shingle according to claim 10 including transverse ribs in said fluid passageway for directing fluid in the passageway against the upper sheet, and

a plurality of support columns extending between the upper and lower sheets,

said columns being inverted cup shaped members extending from the lower sheet to the upper sheet.

12. A solar heating roof shingle according to claim 11, including longitudinally extending reinforcing ribs extending along adjacent the side edges of the body.

13. A solar heating roof shingle according to claim 10, wherein the upper sheet includes a skirt portion overlapping said hollow plug,

the hollow plug includes longitudinally extending ribs dividing the hollow plug into a plurality of outlet openings,

and a cap flange extending longitudinally along one side ege of said shingle for sealingly overlapping a flange on an adjacent shingle.

14. A solar heating roof shingle substantially as hereinbefore described with reference to the accompanying drawings.

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1530980 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

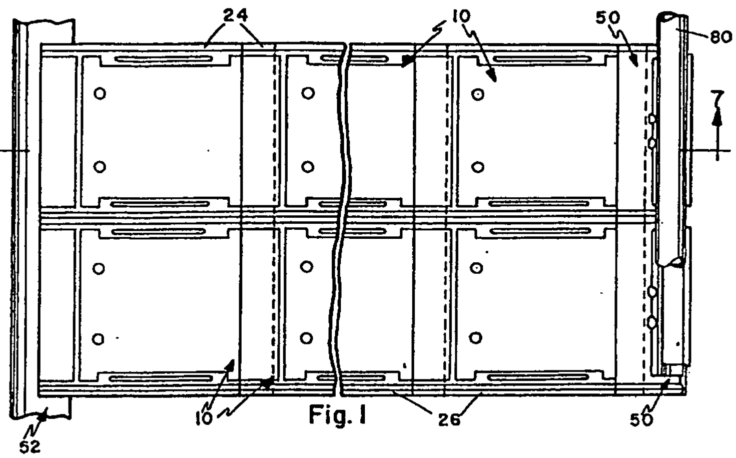

Fig. 1

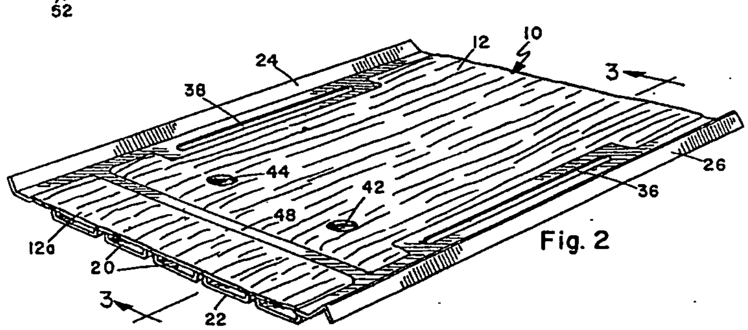

Fig. 2

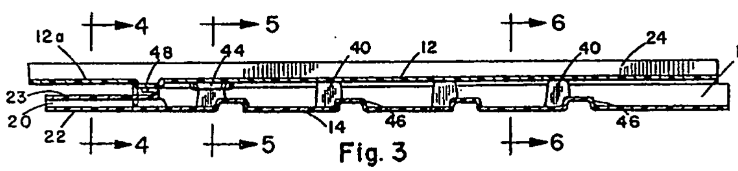

Fig. 3

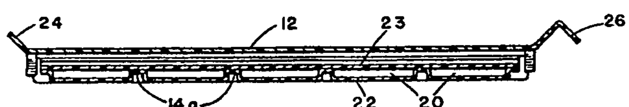

Fig. 4

1530980 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

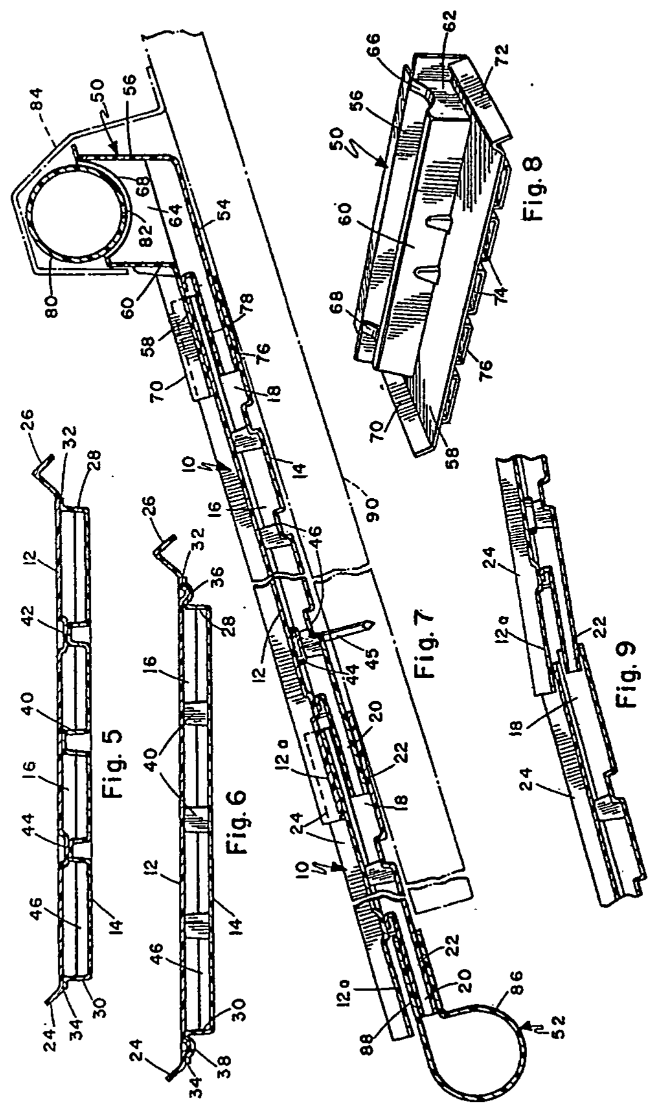

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9